

## Punnett squares – Reference Summary

### A List of Genetic Terminology

- Genotype = genes of the individual
- Phenotype = observable characteristics
- Gene = a unit of hereditary (inheritance)\*
- Allele = alternate forms of a gene. For example, the gene apple color could have different forms (different DNA sequences) such as APPLE<sup>B</sup> (green color) and APPLE<sup>b</sup> (yellow color)
- Gametes = germ cells (egg/sperm)  
Generation = individuals born at the same time from the same parents or their parents' siblings
- P = parent
- F1 = first generation offspring
- F2 = second generation

*\*NOTE: this is the genetic definition of a gene. In terms of molecular biology, a gene is defined as the DNA instructions for a product.*

### Dominant v. Recessive

When in combination, different traits can be either dominant or recessive. If a trait is **dominant**, it will be expressed whenever an allele for that trait is present. If a trait is **recessive**, it will be expressed ONLY when the allele for that trait is present AND dominant alleles are absent.

For example, for the gene that determines the apple color, there may be an allele (B) that codes for green color and an allele (b) that codes for yellow color.

If A is dominant to a (meaning that a is recessive to A), then AA = green, Aa = green, and aa = yellow.

However, some traits have more complicated expression patterns. With the same example gene, **incomplete dominance** would result in a new, blended trait when different alleles are present.

For example: Aa = orange apple

There is also **codominance** in which the traits of both alleles are expressed leading to a mixed trait.

For example: Aa = green and yellow apple

### Punnett Squares

**Punnett Squares** are a method to visually represent the likelihood of potential genotypes (and their resulting phenotypes) of the progeny of a cross (the F1 generation) based on the

genotypes of the parents (see slides for different examples of Punnett squares. Below just one example).

|           |       |   |       |
|-----------|-------|---|-------|
| Parents   | P1    | X | P2    |
| Phenotype | green |   | green |
| Genotype  | Bb    |   | Bb    |

|         |    |             |              |
|---------|----|-------------|--------------|
|         | P1 | gametes     |              |
|         | P2 | B           | b            |
| gametes | B  | BB<br>green | Bb<br>green  |
|         | b  | Bb<br>green | bb<br>yellow |

Shows F1 phenotype  
3 green: 1 yellow

B (green) is dominant to b (yellow); b is recessive to B